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EXTENSIVE INVENTORY OF FOREST RESOURCES

BY MULTISTAGE SAMPLING

GSFC Identification Number 2306A

Contract Number S-54053A

Report date - March 19, 1976

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Extensive Inventory of Forest Resources
by Multistage Sampling

GSFC Identification Number 2306A

Principal Investigator: Robert C. Aldrich

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STATEMENT OF PROBLEMS:

1. When the 2 CCT's for scene 2274-15062, October 23, 1975 (9 track, 2 strips per reel) were read it was found that file 2 of the second tape was missing, i.e., there is no data for the easternmost strip of that scene. We are trying to have EROS replace this tape as soon as possible.

2. Difficulties encountered in combining CCT data for our study area using scenes 2212-15074 and 2112-15081, May 14, 1975, has delayed interpretation and classification by both conventional PI techniques and computer assisted techniques. Hard copy images are now being produced by U.C. Berkeley and should be ready for interpretation by April 1.

3. We had hoped to use the LANDSAT Digital Image Rectification System (DIRS) in our analysis but apparently the system will not be available from Cosmic computer library in Atlanta, Georgia until summer at the earliest. This means it is very unlikely that we can use the system in our current project. Preliminary documentation indicates that the system should be very useful. When the system becomes available, we will examine it more thoroughly for possible use in our future research program.

ACCOMPLISHMENTS:

Photo Interpretation, Mapping, and Photogrammetry:

1. We have now received excellent LANDSAT-1 and-2 data for four dates:

<u>LANDSAT</u>	<u>Scene</u>	<u>Date</u>
1	1080 - 15192 1080 - 15194	October 11, 1972
2	2122 - 15074 2112 - 15081	May 14, 1975

2	2274 - 15062 2274 - 15065	October 23, 1975
2	2310 - 15060 2310 - 15062	November 28, 1975

The 70-mm bulk photographic data have been combined on the I²S image combiner for all scenes. Bulk data tapes (CCT's) have been ordered and received for all scenes except the November 28 scenes. These will be ordered as soon as they are listed in the LANDSAT data Catalog.

2. A 1:125,000 scale map overlay of all 472 forest survey sample plots has been produced using a coordinatograph. Coordinates read from 1:24,000 map sheets with a Numonics Calculator were converted to UTM coordinates and scaled to 1:125,000. The location of each plot on the map overlay is being checked against the 1:24,000 map to determine the plotting accuracy. A Bausch and Lomb Zoom Transfer Scope is being used for this purpose.

3. Interpretation and mapping of the water resources in three counties began and is about 50 percent complete. A multistage inventory has been designed which will begin with first level information taken from Band 7 of LANDSAT Scenes 2310 - 15060 and 2310 - 15062, November 28, 1975. This scene date was considered best of the four available for water resource assessment. This is primarily because drainage patterns are very clear (due to lower sun angle) and because the deciduous hardwoods along streams were leafless to reveal ground water. Length (Kilometers) of streams (those which cannot be measured by area) and area (hectares) of rivers, lakes, reservoirs, estuaries, and other large bodies of water will be estimated for each 1000-meter UTM cell and recorded. The two classes will be treated separately. Cells will be randomly selected from each of the two classes and located on 1:120,000 CIR photographs. Water will be mapped, measured, and interpreted by utility class. A sample of each class will be checked on the ground to determine correct utility classifications and the totals will be adjusted accordingly.

4. Forest assessment has not been started due to problems and delays in obtaining hard copy imagery from the U.C. Berkeley Remote Sensing Research Program. We intend to use this higher resolution enhanced data in conventional interpretation as well as in computer assisted classification. This will make it possible to make direct comparisons between results using the two systems. An inventory has been designed that will include a large area sample on LANDSAT to stratify conifer, hardwood, all forest, all nonforest, and water.

Computer Analysis, Mapping, and Photogrammetry:

1. We have reformatted and combined the CCT's for the 14 May 75 LANDSAT-2 scenes 2112-15074 and 2112-15081 and produced a new tape that

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covers our nine county Virginia test site. From this tape we have had each of the four bands produced as an image by the Remote Sensing Research Program, University of California on their imaging gang optical recorder (IGOR). From these first generation images we will form a color composite for photo interpretation.

2. County boundaries for the nine county test area and 30 well-distributed control points have been digitized and fitted to the LANDSAT image using a least squares technique. A county line map is produced which is registered with the imagery produced from the tapes and can be included in the composite scene.

3. A tape mask has been produced from the digitized county boundary data such that each pixel of the LANDSAT scene can be assigned to a county. After doing our unsupervised and supervised classification of the test area we will be able to produce county by county summaries of the data. Sample selection will be possible on a county basis.

4. Unsupervised classification for selected parts of two counties will begin soon. Unanticipated problems have been resolved in modifying an existing classification program.

Data Standardization and Quantification:

1. The four band radiometer, to be used in aircraft measurements of radiance at the LANDSAT test site, is completed. It is composed of (1) a battery powered electronics case housing four amplifier boards with multiple sensitivity ranges, and (2) a sensor head with four boresighted optical units. Details of the construction of this instrument will appear in the next quarterly report or in a special report during this coming quarter.

2. We were successful in achieving the essential design specifications established prior to and during the breadboarding of the amplifier circuit. These minimum specifications were:

Radiance: $2.0 \times 10^{-5} \text{ W cm}^{-2} \text{ sr}^{-1}$
 Field of view: 11° full angle
 Radiant power on detector: $6.1 \times 10^{-7} \text{ W}$
 Detector current: $1.6 \times 10^{-7} \text{ A}$
 Voltage output: 3.0 V
 Decades of sensitivity
 (above minimum): 4
 High frequency noise
 (peak to peak): 5 mV

Zero offset: ± 1 mV
 DC drift: 10 mV Hr^{-1}
 Time response
 (rise and fall times): $1.5 \times 10^{-4} \text{ s}$
 (settling time): $4 \times 10^{-4} \text{ s}$

3. The radiometer was operated during a short test flight near Concord, California on March 15, 1976. The sensing head was mounted on a newly constructed mount, which also held a boresighted video camera. The system functioned as expected except for some minor problems. Irradiance measurements, through a viewing port atop the aircraft, were thwarted by a loose mounting fixture. The fixture had not been tightly secured during a recent aircraft modification. This problem can easily be corrected.

Aircraft and Ground Data Acquisition:

A test flight on March 15 resulted in radiance data taken at altitudes of 245 m and 490 m over agricultural areas, and at 490 m over a mixed oak and pine forest area. The total time of data acquisition on the flight lines was about 15 minutes. Total product of flight line length and number of bands was 96 Km-band^L.

The radiance data is recorded on analog charts and the support imagery is recorded on video tape. The data will be screened for signal anomalies, and for evidence of operator errors. We plan to make a compilation of mean radiance values for specific terrain types, such as plowed fields, turbid water, crops and various forest slope-aspect combinations. These values should aid in future experimental design and procedural decisions.

SIGNIFICANT RESULTS:

There are no significant results to be reported at this time.

PUBLICATIONS:

None.

RECOMMENDATIONS:

There are no recommendations to be made at this time.

FUNDS EXPENDED: \$2,000.00

DATA USE:

	<u>Value of Data Allowed</u>		<u>Value of Data Ordered</u>	<u>Value of Data Received</u>
ASCS (A/C Imagery)	\$1,500.00		00.00	00.00
ASCS (LANDSAT Imagery)	500.00 ^{1/}		209.00	209.00
EDC (CCT's)	2,400.00		400.00	400.00

^{1/} Effective 2-1-76, \$100.00 increase from GSFC